Trichromothrips veversae sp.n. (Insecta, Thysanoptera), and the Botanical Significance of Insects Host-specific to Austral Bracken Fern (*Pteridium esculentum*)

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Austral bracken fern, *Pteridium esculentum*, differs from its European counterpart in supporting one species of both thrips and aphid. The previously undescribed species of thrips, *Trichromothrips veversae* sp.n. (Thripidae), is widespread and locally abundant in southern Australia breeding on the youngest fronds of bracken but not on other ferns. It is unique among nearly 30 species of this Old World tropical genus in lacking long setae on the pronotum.

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INTRODUCTION

Common bracken fern is often considered to be a single, cosmopolitan species *Pteridium aquilinum* (Dennstaedtiaceae). In retaining this view, the major reference work on botanical nomenclature (Mabberley, 1997) recognised two subspecies, the nominate one from the Northern Hemisphere and Africa, and *P. aquilinum caudatum* from the Southern Hemisphere. In Australia, in contrast, Brownsey (1989) recognised three species of *Pteridium*: *P. aquilinum* introduced to a small area of South Australia in the Adelaide Hills; *P. revolutum* native to north-eastern Queensland but extending widely across New Guinea and South East Asia; and *P. esculentum* native to southern and eastern Australia but extending to South East Asia and the Pacific. More recently, Thomson (2000) has concluded from an extensive study of both structural and molecular characters that several of the *Pteridium* varieties distinguished worldwide, including *esculentum*, "might best be treated as species".

These differences in opinion concerning the botanical status of bracken fern are not without entomological significance. No species either of aphid (Homoptera) or of thrips (Thysanoptera) is known to live on bracken in Europe, where this plant is widespread and abundant and often an invasive weed. In contrast, the aphid species *Shinjia orientalis* (Mordwilko) (= *S. pteridifoliae* Shinji) has been reported widely on *Pteridium* from northern India and Japan to eastern Australia. Moreover, populations of bracken in eastern North America support another aphid species, *Mastopoda pteridis* Oestlund, and in western North America five aphid species in the genus *Macrosiphum* have been reported from *Pteridium* (V. F. Eastop, 2003 pers. comm.). If *Pteridium* were truly monotypic, comprising one worldwide panmictic species, then different populations might be expected to support similar, if not identical insect species. The description here of a new species of Thripidae that is widespread on bracken in Australia would thus appear to provide further support for the recognition of distinct species within this ubiquitous plant genus. Presumably these insects are reflecting diversity within the genus *Pteridium* that botanists have been reluctant to acknowledge.

The existence of this thrips species had been suspected for many years. In 1967, the wife of the eminent Australian insect ecologist H.G. Andrewartha, Hattie Vevers-Steele after whom the new species described below is named, drew the attention of one of us (LAM) to some specimens of a thrips species taken from bracken near Adelaide during her studies on Australian Thysanoptera (see Mound, 1996). The specimens were in poor condition, and efforts at that time to locate the species in the field were not successful. However, during the past 10 years this thrips has been found to be widespread across southern Australia, but breeding only in the curled apices of the youngest fronds of bracken. This species was listed by Shuter and Westoby (1992) from a population of bracken near Sydney as "Anaphothripinae gen. et sp.

indet", but is here recognised as a new species of the widespread Old World genus *Trichromothrips*. However, within that genus it exhibits one remarkably deviant autapomorphy – the absence of any long setae on the pronotum. This thrips has been found only on *Pteridium esculentum*, as defined by Brownsey (1998), even when this has been found growing in association with other ferns that are superficially similar, such as the closely related *Hypolepis muelleri* (Dennstaedtiaceae), or young specimens of the more distantly related tree fern *Dicksonia antarctica* (Dicksoniaceae). No thrips have been found on any species of *Hypolepis*, although *Scirtothrips frondis* Hoddle and Mound breeds abundantly on the youngest fronds of *Dicksonia* and has also been taken on a species of *Cyathea* (Hoddle and Mound, 2003).

Trichromothrips Priesner

Trichromothrips Priesner, 1930: 9. Type species *T. bellus* Priesner.

Bhatti (2000) has fully defined and reviewed this genus, synonymising the genus *Dorcadothrips* Priesner and providing a key to identify the 27 included species. Of these, 24 are from the Old World, between Africa and Queensland but mostly from South East Asia. The other three species, two from Hawaii and one widespread, may also have come originally from the Oriental region. The collection data for most of the species are probably not reliable indicators of the plants on which these thrips breed, but two species (*T. billeni* Strassen and *T. bilongilineatus* Girault) are associated with ferns (Mound, 2002b), and in the region of Japan around Tokyo and Yokahama, *T. alis* Bhatti or a closely related species is found on a species of *Polystichum* (Dryopteridaceae). Finally, three related genera of Thripidae are also associated with ferns, *Laplothrips* Bhatti, *Octothrips* Moulton and *Pteridothrips* Priesner (Mound, 2002b).

Members of these four genera are unusual in bearing a pair of setae on the dorsal apical margin of the first antennal segment. This character state is also shared by species in the following genera of Thripidae, although none involves fern-living species: *Alathrips* Bhatti, *Bregmatothrips* Hood, *Ceratothripoides* Bagnall, *Craspedothrips* Strassen, *Diarthrothrips* Williams, *Furcithrips* Bhatti, *Megalurothrips* Bagnall, *Mycterothrips* Trybom, *Odontothrips* Amyot and Serville, *Odontothripiella* Bagnall, *Pezothrips* Karny, *Sorghothrips* Priesner, *Watanabeothrips* Okajima, *Yoshinothrips* Kudo. Moreover, although the two species comprising the Oriental genus *Bathrips* Bhatti lack this pair of setae on the dorsal apical margin of the first antennal segment, they share many other character states with *Trichromothrips* species, and these two genera are possibly closely related.

***Trichromothrips veversae* sp.n.**

Holotype ♀ macroptera, **Australian Capital Territory**, Woods Reserve, from young fronds of *Pteridium esculentum*, 6.xii.2002 (LAM 4244), in ANIC, CSIRO Entomology, Canberra.

Paratypes: 2 males, 17 females, same host, date and locality as holotype (Masumoto, Mound and Wells); 3 females at same locality but 16.i.1999 (LAM 3664).

Specimens excluded from the type series were collected widely in southern Australia, including Tasmania, Western Australia, New South Wales, and the Australian Capital Territory (see Distribution below).

Female macroptera

Colour: body yellow with orange pterothorax, ocelli bright red, antennae brown, abdomen with transverse light brown markings, wings shaded; colour of cleared and mounted specimens yellow, tergites shaded anteromedially and along antecostal line, IX and X shaded, mesonotum and metanotum weakly shaded; head and antennal segment I pale, segments III to VIII almost uniformly dark brown with extreme base of segments III to V slightly paler, II paler than segment III; all legs greyish brown; fore wing and scale greyish brown, but base of fore wing paler.

Structure: Head slightly wider than long, not prolonged in front of eyes, with a few transverse striae posteriorly on vertex (Fig. 1); ocellar setae I absent, setae III no longer than length of an ocellus and arising between anterior margins of posterior ocelli; three pairs of postocular setae, pairs I and II close together behind ocelli; ventral surface of head with 5 pairs of setae between compound eyes anterior to anterior tentorial pits; mouth-cone rounded, maxillary palpi 3-segmented; compound eyes without pigmented facets. Antenna 8-segmented (Fig. 3); forked sense-cones on III and IV exceptionally stout; segment I with 2 dorsal apical setae; II with weak microtrichia laterally only, III to VI with a few large microtrichia on dorsal and ventral surfaces; III with 2 dorsal and 2 ventral setae.

Pronotum medially with few or no lines of sculpture and 4 to 10 discal setae; posterior margin with five pairs of setae, none of which is longer than the discal setae. Mesonotum with weak transverse lines of sculpture, without campaniform sensilla near anterior margin, median pair of setae far ahead of posterior margin. Metanotum (Fig. 2) medially without sculpture and one pair of small setae far from anterior

Figure 1. ***Trichromothrips veversae*****, head and pronotum.**

margin, without campaniform sensilla. Prosternal ferna not divided; mesothoracic sternopleural suture not developed; meso- and metasternum each with well-developed spinula. All tarsi 2-segmented. Forewing veinal setae short, less than half width of wing in length; first vein with about 8 setae near base and 2 (rarely 3) setae near apex; second vein with about 10 setae; posterior fringe cilia wavy; forewing scale with 4 marginal setae.

Abdominal tergites without posteromarginal craspeda or lateral ctenidia; tergites II to VIII without sculpture medially, lateral to seta S2 with about 7 anastomosing transverse lines bearing tuberculate microtrichia; tergite VIII without posteromarginal comb; tergite IX with paired campaniform sensilla posteromedially; tergite X undivided; pleurotergites without discal seta, sculpture similar to lateral areas of tergites. Sternites without discal setae; sternite II with two pairs of posteromarginal setae, sternites III to VII with three pairs, on VII all three pairs arise in front of sternal posterior margin.

Measurements (holotype female in µm with small paratype female in parentheses): Body length 1400 (1100). Head, length 90 (85); width 125 (105). Pronotum, length 105 (95); width 160 (130); posteromarginal setae 15 (12). Forewing, length 750 (650). Antennal segments 25, 32, 50, 57, 40, 43, 10, 17 (25, 30, 40, 47, 35, 37, 7, 15).

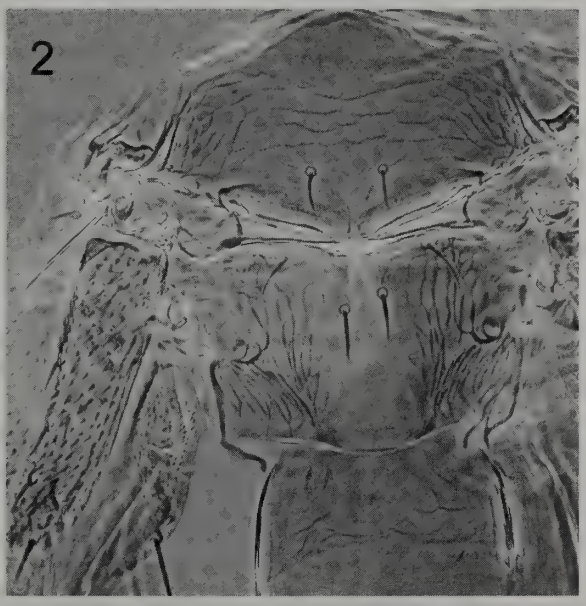
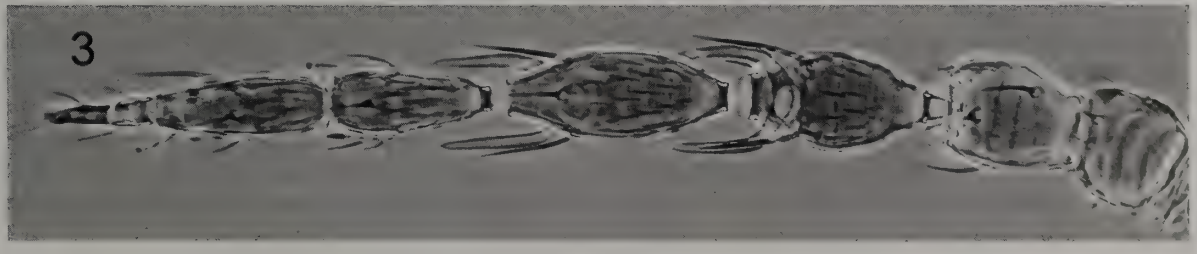


Figure 2. ***Trichromothrips veversae*****, mesonotum and metanotum.**

Male aptera

Colour paler than female. Structure similar to female except: forked sense-cones on antennal segments III and IV small and slender; one of three available males lacks ocellar setae II; mesonotum transverse with 4 or 5 setae near lateral margins; pleurotergal sutures weakly developed; tergite IX

Figure 3. ***Trichromothrips veversae*****, antenna.**



posterior margin with horn-like paired drepanae extending beyond segment X; sternites III to VIII each with about 50 small, irregularly arranged, glandular areas, marginal setae arising at margin on all sternites.

Measurements (paratype male in µm). Body length 1000. Head, length 83; width 100. Pronotum, length 85; width 130; posteromarginal setae 15. Tergite IX drepanae length 60. Antennal segments 25, 30, 37, 40, 32, 37, 7, 15.

Larva II.

Colour pale yellow with red eyes, progressively developing extensive pale red hypodermal pigment in meso- and metathorax and anterior abdominal segments, body usually turning deep yellow progressively; major dorsal setae parallel-sided with bluntly square apices, 3 pairs on head, 6 pairs on pronotum, 3 pairs on abdominal tergites II – VIII, 2 pairs on IX, antennal II with 2 pairs of similar but smaller setae; setae on tergite X and abdominal sternites with apices acute; sternite IX posterior margin with row of about 30 small tooth-like tubercles.

Systematic relationships

Currently, this new species cannot be placed in any of the 10 species-groups distinguished by Bhatti (2000) within *Trichromothrips*, although it shares with the other 27 species the many character states listed by that author in his diagnosis of the genus. In contrast to those species, it lacks any long pronotal setae, the metasternal spinula is well developed not weak, and females have unusually stout antennal sense cones.

In Australia, only one other species of *Trichromothrips* has been collected in good numbers: *T. bilongilineatus* (Girault) from ferns near Gosford (Mound, 2002a). Of the other two members of the genus listed from Australia, the record of *T. xanthius* (Williams) is based on one female taken in quarantine in North America but labelled as coming from Australia (Mound, 1996), and *T. obscuriceps* (Girault) is known from a single sample apparently taken on *Crinum* lilies near Brisbane. The genus is probably well established in northern Australia, but only a few specimens are available, representing two further unidentified species, swept from grasses near Darwin. All of these species have long pronotal posteroangular setae.

The lack of long pronotal setae gives *T. veversae* the superficial appearance of an *Anaphothrips* species. This is another example of the ineffective supra-generic classification within the subfamily Thripinae, in which traditional subtribal names such as Aptinothripina do not refer to definable groups (Mound, 2002c), despite their continued use by various authors (eg. Vasiliu-Oromulu et al. 2001). There are several unrelated Thripinae genera in which species usually have two pairs of long pronotal setae, but in which one or more species have these setae no longer than the discal setae and are thus "Anaphothripine" in appearance, eg. *Dichromothrips* Priesner, *Pseudanaphothrips* Karny and *Thrips* Linnaeus.

The presence or absence of long setae on the pronotum was recognised as a poor indicator of phylogenetic relationships by Mound and Palmer (1981), who proposed a series of informal genus-groups within the Thripinae. These authors included *Scolothrips* Hinds, a genus of predatory thrips, in their *Dorcadothrips* genus-group (Mound and Palmer, 1981). *Scolothrips* species resemble some *Trichromothrips* species in general appearance, for example the pale slender body and bulging compound eyes, but they have very long ocellar setae and the pronotum bears six pairs of elongate setae. Moreover, the dorsal apical margin of the first antennal segment does not bear a pair of setae, and the mesosternal sternopleural sutures are weakly developed. The character state on the first antennal segment discussed above suggests that the genus-groups recognised by Mound and Palmer (1981) require reappraisal.

Distribution and host records

T. veversae has been found to be locally abundant in many parts of southern Australia, including Western Australia near Albany, Tasmania near Hobart, and various sites in South Australia (Adelaide Hills; Cox's Scrub south of Adelaide; and Kangaroo Island). It is abundant in the mountains of the ACT, and is widely distributed in the eastern forests of New South Wales from near Eden to the Blue Mountains. It possibly occurs even further north, but a sample taken from *Pteridium* at Beerwah, north of Brisbane, yielded only *Scirtothrips dobroskyi* Moulton (Hoddle and Mound, 2003). In a survey of the insects associated with bracken in New Guinea, Kirk (1977) does not mention thrips, but since thrips on ferns are associated only with very young fronds, or even with croziers that are not yet fully expanded, these minute insects are often difficult to detect. Similarly, the list given by Balick et al. (1978) of insects taken from ferns worldwide is based on a survey of published records, derived mainly from general collecting, and some of the thrips species listed are fungus-feeders, not fern-feeders. Mound (2002b) emphasised that several published records of thrips on ferns are based on single samples or even single specimens, and thus cannot be relied on to indicate a host relationship.

In Japan, the common species of bracken fern is considered also to represent *Pteridiium esculentum*

and, as indicated above, the aphid species *Shinjia orientalis* has been recorded from this plant in Japan as well as Australia. However, searches for thrips on substantial populations of bracken in Japan, particularly near Narita City, have failed to discover *Trichromothrips veversae*.

At Crafers in the Adelaide Hills, South Australia, a substantial population of adults and larvae of *Thrips imaginis* Bagnall was found on bracken fronds in an open field during December 2002, together with a few larvae of *Trichromothrips veversae*. However, this seems to be a rare host association for the highly polyphagous Australian Plague Thrips.

At several sites, near Adelaide and on Kangaroo Island, larvae of *T. veversae* were found bearing up to 12 larval Eucharitidae (Hymenoptera). This is presumably a phoretic association, but no observations were made on associated ants, the probable host of these small wasps.

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REFERENCES

Balick, M., Furth, D.G. and Cooper-Driver, G. (1978). Biochemical and evolutionary aspects of arthropod predation on ferns. *Oecologia* **35**, 55-89.

Bhatti, J.S. (2000). Revision of *Trichromothrips* and related genera (Terebrantia: Thripidae). *Oriental Insects* **34**, 1-65.

Brownsey, P.J. (1989). The taxonomy of Bracken (*Pteridium*: Denstaedtiaceae) in Australia. *Australian Systematic Botany* **2**, 113-128.

Brownsey, P.J. (1998). Denstaedtiaceae, pp. 214-228 in *Flora of Australia* volume **48**. Ferns, Gymnosperms and Allied Groups. CSIRO, Melbourne.

Hoddle, M.S. and Mound, L.A. 2003. The genus *Scirtothrips* in Australia (Insecta, Thysanoptera, Thripidae). *Zootaxa* **268**, 1-40.

Kirk, A.A. (1977). The insect fauna of the weed *Pteridium aquilinum* (L.) Kuhn (Polypodiaceae) in Papua New Guinea: A potential source of biological control agents. *Journal of the Australian Entomological Society* **16**, 403-409

Mabberley, D.J. (1997). *The Plant Book*. Second edition. Cambridge University Press, Cambridge.

Mound, L.A. (1996). Thysanoptera, pp 249-336, 397-414 (Index), in Wells, A., *Zoological Catalogue of Australia*. Volume 26. Psocoptera, Phthiraptera, Thysanoptera. Melbourne. CSIRO Australia.

Mound, L.A. (2002a). Thrips and their host plants: new Australian records (Thysanoptera: Terebrantia). *Australian Entomologist* **29**, 49-60.

Mound, L.A. (2002b). *Octothrips lygodii* sp.n. (Thysanoptera, Thripidae) damaging weedy *Lygodium* ferns in south-eastern Asia, with notes on other Thripidae reported from ferns. *Australian Journal of Entomology* **41**, 216-220.

Mound, L.A. (2002c). The *Thrips* and *Frankliniella* genus-groups: the phylogenetic significance of ctenidia, pp. 379-386 in Mound L.A. and Marullo, R. [eds] *Thrips and Tospoviruses. Proceedings of the 7th International Symposium on Thysanoptera*. Australian National Insect Collection, Canberra.

Mound, L.A. and Palmer, J.M. (1981). Phylogenetic relationships between some genera of Thripidae (Thysanoptera). *Entomologica Scandinavica* **15**, 153-17.

Priesner, H. (1930). Contribution towards a knowledge of the Thysanoptera of Egypt, III. *Bulletin de la Société Royal Entomologique d'Egypte* **14**, 6-15.

Thomson, J.A. (2000). Morphological and genomic diversity in the genus Pteridium (Dennstaedtiaceae). *Annals of Botany* **85**, 77-99.

Vasiliu-Oromulu, L. zur Strassen, R. and Larsson, H. (2001). The systematic revision of Thysanoptera species from the Swedish fauna and their geographical distribution. *Entomologia romana* **6**, 93-101.